The classic discussion of this sort of thing is to be found in Sir Francis Galton's "Inquiries into Human Faculty and its Development" (London, Macmillan, 1883). This has been reprinted in Everyman's Library. Since that time very little has been written in English on the subject. With the exception of a letter in NATURE (vol. xliv., p. 223, 1891) and two papers by Miss M. A. Calkins in the *American Journal of Psychology* (1892), there has been nothing published on the subject until my articles in 1905 and 1908 respectively appeared in the *Edinburgh Medical Journal* and in the *Journal of Abnormal Psychology* (Boston, U.S.A.). The *British Review* of April, 1913, published a popular account of colour-hearing by C. C. Martindale.

D. FRASER HARRIS.

Dalhousie University, Halifax, Nova Scotia,
December, 1920.

APPENDIX.

Coloured Concepts or Psychochromes of Miss A. M.

a, creamy-white; b, shade clearer than "d"; c, pink; d, indigo, dirty (gritty) blue; e, black (wet); f, dry brown; g, black on white; h, darkish fawn, like chocolate blancmange; i, black; j, dirty, pearly, bluish-white; k, clear brown, edged with mustard-yellow; l, yellow; m, jade-green; n, pea-green; o, black; p, darker green, bluer; q, black, with red tinge; r, dry red; s, crimson, scarlet; t, deep black-red; u, dark grey, almost black; v, very dark navy, blue and green; w, not so dark, green and navy; x, brownish-mustard-yellow, very ugly; y, almost neutral bluish-green; z, like "x," but a little yellower.

Sunday, golden-yellow, with a fleck of green in the middle; Monday, pretty light green; Tuesday, dark blue with red flecks; Wednesday, soft, deeper green; Thursday, like Tuesday, with more red; Friday, brown, soft like suède gloves; Saturday, bright scarlet.

January, clear, intense pale green, like ice; February, dirty light reddish-brown; March, green and red at end; April, fresh, pale yellow; May, very pale green, almost white; June, green; July, yellow and royal blue; August, golden-yellow; September, red and brown (autumn); October, navy blue; November, brown with yellow edges; December, dirty, almost colourless, made up of black, navy blue, and dark green.

Christmas, pink (Christ), red and green (mas); Easter, creamy-white.

1, black; 2, creamy-yellow; 3, red, pale; 4, brown; 5, bright, wet red; 6, dull indigo; 7, ugly yellow; 8, white; 9, green; 10, black; 11, black and yellow; 12, creamy-yellow.

The twenties, yellow; the thirties, reddish; the forties, brown; etc. The hundreds are the same.

Synaesthesiae.

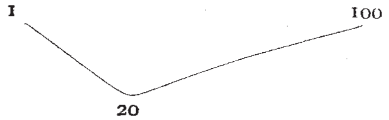
Pains have colours, but following the colours of the names, *i.e.* sore, red; ache, opaque-whitish; sprain, greenish-red; cut, blue and red; bruise, blue and red.

Tastes are only slightly coloured: acid are sharp, penetrating yellow; sweet, soft yellow. Odours, only slightly, either grey or yellow: a musty smell is grey and red; acrid, yellowish-grey. Touch, not at all: heat is yellow, and different degrees different shades up to a pure white, which is cold.

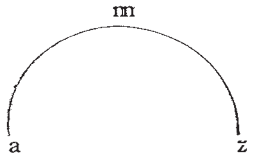
Music is the only thing that makes Miss A. M. see purple and violet. Deep organ notes blend from blue to purple, but only music. Even the names "purple" and "violet" she sees only by the letters which make them up. If "violet" had not a "t" at the end it would be merely dark blue and the same with the "r" in purple. The lowest organ notes are, to her, deep purple, like a bruise, while the very high notes are yellow and pink.

Psychograms.

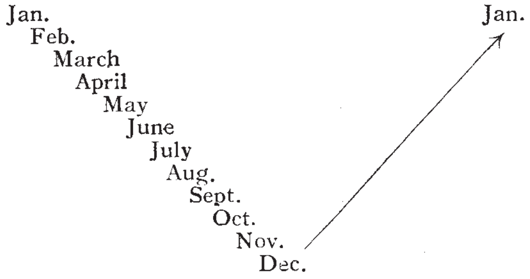
Numerals go like this:



The alphabet goes like this:



The months go like this:



The week between Christmas and New Year's Day stretches back to January.

Days of the week go like this:

Sat. Sat.
Sun. Fri.
Mon. Thurs.
Tues. Wed.

Heredity and Acquired Characters.

MR. J. T. CUNNINGHAM remarks (NATURE, January 13, p. 630): "Provided that biologists understand one another, it is, perhaps, not an insuperable barrier to the progress of biology that Sir Archdall Reid is unable to understand their terminology." Prof. MacBride declares (*ibid.*): "I have attended many congresses of biologists, and I have never found evidence of confusion in their minds as to what was meant by an 'acquired character.'" I feel humbled, but not enlightened.

As far as I am able to understand Mr. Cunningham's letter, he regards as "acquired" everything which develops in response to use, and everything else as "innate." Herein he agrees with Lamarck and Sir Ray Lankester, but differs from a host of other writers, including Spencer, Wallace, Romanes, and Weismann, all of whom regarded the effects of injuries as "acquired" characters. He differs even from himself, for he has, when arguing in favour of the transmission of acquirements, attributed the evolution of antlers to the effects of irritation (injury). He differs in the same issue of NATURE from Prof. MacBride, according to whom "'acquired character' is a technical term; by it is meant a quality, *i.e.* the degree of development of an organ, which is produced as a response to function, altered from the normal in response to an alteration of the environment from the normal." Whence it follows that, while Mr. Cunningham would term the muscular development of the ordinary man "acquired," Prof. MacBride would call it "innate," and would limit the term

©1921 Nature Publishing Group

"acquired" to such developments as the blacksmith displays. If everyone worked as blacksmiths, Prof. MacBride would differ still more from Mr. Cunningham, for the whole of development would then be termed by the former "innate" and by the latter "acquired." To Mr. Cunningham the English language is always an acquirement; to Prof. MacBride it is innate if learned in England, but acquired if learned in France.

Formal definitions of the meanings of the terms "innate" and "acquired" when applied to characters are extremely rare in biological literature—unless such terms as "germinal" and "somatic" be attempts at definition. However, Romanes made the attempt. This is what he says ("An Examination of Weismannism," p. 5): "By a congenital character is meant any individual peculiarity, whether structural or mental, with which the individual is born. By an acquired character is meant any peculiarity which the individual may subsequently develop in consequence of its own individual experience." Elsewhere (p. 214) he defines congenital (plasmogenetic) characters as "variations due to admixtures of germ-plasm in acts of sexual fertilization (and, therefore, present at birth), as distinguished from somatogenetic characters—variations which have been acquired independently of germ-plasm." Somatic characters he defines as "characters acquired by the soma (*i.e.* variations acquired after birth by the action of the environment), as distinguished from characters produced and potentially present from the first by a union of two masses of germ-plasm—plasmogenetic characters." Romanes's language may be lacking in precision, but evidently he supposed that there is something peculiarly "innate" about a "germinal" character and something peculiarly "acquired" about a "somatic" character. Unlike Prof. MacBride, he gives all these terms their ordinary or dictionary meanings—and so, I believe, do most biologists.

Dr. Ruggles Gates (NATURE, January 20, p. 663) believes I contradict myself. It is possible he has not grasped my meaning. An illustration may help. Before me are two pencils. Comparing these individuals, I find that their differences as regards length are great, but as regards colour small. Dr. Gates will agree that I am not entitled to transfer the terms by which I described the differences between the individuals to the characters wherein they differ—*i.e.* I am not entitled to call the lengths of the pencils great and their colours small. That way lies confusion of thought. Now consider two living individuals, the one an Englishman and the other a scarred negro. They differ in colour innately—they are in this respect by nature different; their germ-plasms are unlike; even if reared under exactly similar conditions of nurture they would be unlike. They differ in scars by acquirement; here they have had not unlike natures, but unlike nurtures; if reared under similar conditions they would be like. In brief, the colour difference is blastogenic, while the difference in scars is somatogenic. All this is intelligible; the words are used correctly. They are given their ordinary meanings; they are not in the least technical. But are we now entitled to transfer our descriptive terms from the differences between individuals to the characters in which they differ? Are we entitled to call skin-coloration "innate" and scars "acquired"? We are now comparing, not separate individuals, but the characters wherein they differ. In effect, we are comparing the characters of the same individual. How is skin-colour more innate and less acquired than a scar? They are both ancient products of evolution, both depend on germinal potentiality, both develop in response to some form of nurture, and both are situated in the soma.

Dr. Ruggles Gates writes: "I pointed out (NATURE, December 2, p. 440) that if his contention that all characters are both innate and acquired in exactly the same sense and degree is true, then it would follow that all variations are also of one type, while experimental biologists are universally agreed that this is not the case. At least two categories of variations are postulated . . . blastogenic and somatogenic. . . . Yet Sir Archdall Reid's only attempt to answer my criticism that the universally admitted existence of two types of variations undermines his whole position is the very weak one of quoting Darwin's tentative theory of pangenesis." But I did not quote the theory of pangenesis *against* Dr. Gates; I was merely trying to make my meaning clear. And surely the word "variation" indicates, not a character as such, but a difference between individuals. Resemblances do not necessarily exclude differences. A cleft lip is always a character in both man and rabbit; but it is a variation in the former, but not in the latter. A sixth digit resembles all other digits in that it is a product of nature and nurture; and yet (if the parent has it not) it is none the less a variation. So also a sixth digit resembles a scar in that it is a product of potentiality and stimulus; and yet it differs from the latter in that the unlikeness from the parent is innate, whereas it is acquired in the case of the scar. The resemblances between the two do not necessarily eliminate their differences. How, then, is my whole position undermined?

G. ARCHDALL REID.

9 Victoria Road South, Southsea.

Man and the Scottish Fauna.

I AM grateful to your reviewer (NATURE, December 30, 1920, p. 568) for his appreciation and for pointing out slips and misprints in my "Influence of Man on Animal Life in Scotland," but on some points of fact I would venture to disagree with other of his remarks.

Geologists will not be perturbed by his difficulty in believing in the persistence of evidence of man's presence in Scotland from times earlier than the formation of the 25-ft. beach. Sections of many places have shown that the 25-ft. beach, of estuarine material, *rests upon* the boulder clay, so that it is certainly not "clear that the land ice was grinding over all after the elevation which formed the younger 25-ft. beach." On the contrary, the evidence is that the 25-ft. beach was formed subsequent to the disappearance of the ice-fields. The relations of the 50-ft. beach are not so clear, but facts have to be explained on reasonable suppositions. And the occurrence of kitchen-middens of molluscan shells along the ridge of the 50-ft. beach in the Forth Valley is more easily accounted for on the supposition I have advocated—that they were collected while the 50-ft. beach was still a sea-margin—than on that of your reviewer, who would have the kitchen-middeners collect their shell-fish on the seaside, now a great distance away, and thereafter scale first the 25-ft., and afterwards the 50-ft., beach before sitting down to their simple meals.

On the strength of a reference by Thomas the Rhymer, your reviewer suggests that I have erroneously omitted the green woodpecker from the list of banished Scottish animals. But both ornithologists (such as Yarrell and Newton) and etymologists (as in Wright's "Dialect Dictionary") are agreed that the word "wodewale," on which the whole value of the citation hangs, is a general word for a woodpecker, and applied to the great spotted as well as to the green woodpecker. The word has no specific significance. There seems to be, indeed,

©1921 Nature Publishing Group